The Northwestern MILLER
MILLING PRODUCTION SECTION

Efficient Layout and Operation of Formula Feed Plants

By PAUL O. BERG

A GENERAL in the Confederate Army explained the secret of his military success was to "git there fustest with the mostest." The secret of a successful feed mill operation is to operate it the "bestest with the leastest."

Interest in the methods of reducing operating costs through increased plant efficiency is growing in the formula feed industry. With increasing labor costs on the one hand and increasing competition on the other, the operator of a feed mill has good reason to be searching constantly for cost-cutting techniques.

My experience does not extend beyond the period before World War I but an engineer my senior once told me that no effort was made then to conserve fuel in the power plant field. Shortages that developed during World War I forced people to recognize the tremendous savings that could be made through efficient measures and as a result a great change took place in fuel utilization in power plants. That urge to increase efficiency has never diminished and new and better equipment is constantly being developed.

EDITOR'S NOTE: The accompanying article was adapted from the text of an address presented by Mr. Berg before a meeting of the Indiana Grain & Feed Dealers Assn., Inc. The author is a consulting engineer, specializing in grain processing plant design. He maintains offices in Ft. Wayne, Ind.

The formula feed industry, under the pressure of World War II, came to realize tremendous savings were possible through more efficient methods. Technological advances such as more precise weighing equipment, automatic controlling devices, etc., are available to the feed industry and the question is: How can we take advantage of these advances to improve the efficiency of our plants?

The formula feed industry is big business and it is no longer possible to meet competition today if your plant uses methods that were the best 30 or 40 years ago. I read recently that 60% of the farmers in the Midwest are not consistent buyers of formula feeds and that 50% of the potential formula feed market is not covered. The figures are probably indicative of the market potentialities in Canada as well. Here, then, is a market awaiting the industry if it can improve its production facilities to make feed available at a cost attractive to farmers not now using formula feed.

Analysis of Plant Operations

There is no better single way to improve plant operation than by developing a well-planned arrangement of productive equipment and facilities. If we analyze the job of planning, we will find there are two distinct aspects. First, there is the plant as a whole, the relationship of the different operations to each other and the general arrangement of the entire mill. Second, there are the individual operations which must be considered separately with regard to their arrangement and adequacy.

Planning can be for one or the other, but it must take in both aspects at the same time to be complete.

In considering the first aspect—the plant as a whole and the relationship of different operations—we are dealing in terms of the general arrangement of buildings and operations and we have things that are difficult to change. It is not as easy to move an entire operation as it is to move one piece of equipment. For this reason it is very important that the overall planning be basically correct.

I frankly believe that more formula feed mills suffer for lack of good overall arrangement than they do for lack of good equipment.

The rapid growth or increase in capacity of plants is one of the principal causes for poor arrangement and less efficient operations. New units have been added where most logical at the time they were installed but gradually the overall arrangement became distorted and correction became difficult.

In remodeling it is usually a question of how much of the old mill is useable and adaptable. Remodeling costs run high, since it is necessary to do considerable tearing down, before rebuilding can be started.

If a mill as it is originally built is substantial and of the proper proportions and the location on the property is correct with relation to railroad sidings and roads, it is entirely possible to make very good use of what exists.

Buildings and property have value and, compared to the equipment, they represent about half the total expenditure.

The value of a new plant should not be overlooked. During the years that the old mill has stood, the town has changed considerably and the plant location, while it was good years ago, may be obsolete today. Even though there is a sizeable investment represented, there are the advantages of having no restrictions in a new location. A new mill also has a product sales value that is hard to measure in dollars but is important and is recognized by all.

In making a plan it is necessary to think in terms of arrangement of operations and not of building size. I have heard people talk about a feed mill in terms of the building requirements first. The building is of secondary importance and the milling equipment is first to be considered.

If the building is put at the top in importance, then the equipment arrangement must conform to the building and this results in compromises that are usually at the expense of efficiency. This is one of the reasons why remodeling is difficult if the buildings to be remodeled are not adequate.

In order to plan a feed mill to provide for the least amount of interference between the different operations, I like to think of the arrangement shown in Figure 1.

Feed mills differ so much in their requirements and so many factors influence the design that there is no such thing as the typical feed mill. The arrangement shown in Figure 1, however, will illustrate the basic parts of a mill and how they would relate to each other.

The working area is in the center. Here the preparation is performed, such as grinding, crushing, crimping, etc. The mixing is done here along with the packaging. This area belongs between any bulk storage that is used and the flat storage for sacked ingredients and finished feeds. With this arrangement, inbound materials can come into any one of the three areas without interference. Also the movement of materials between the three areas is shorter and without interference. The outbound materials are located on the opposite side of the area from the inbound stocks. This also prevents interference.

Referring to Figure 2, it will be noted how the bulk storage can be increased with this arrangement. The working area can be expanded into the warehouse building which is the most adaptable for equipment. Trackage can be expanded with this arrangement and if property is available on either side of the trackage, it can be used for additional bulk or warehouse storage or for any special use.

We should think first of the overall plan when we are considering re-

(Continued on page 21a)

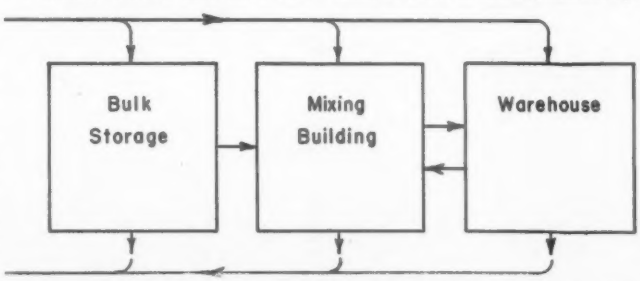

Fig. 1—Basic parts of a feed mill and how they should relate to each other.

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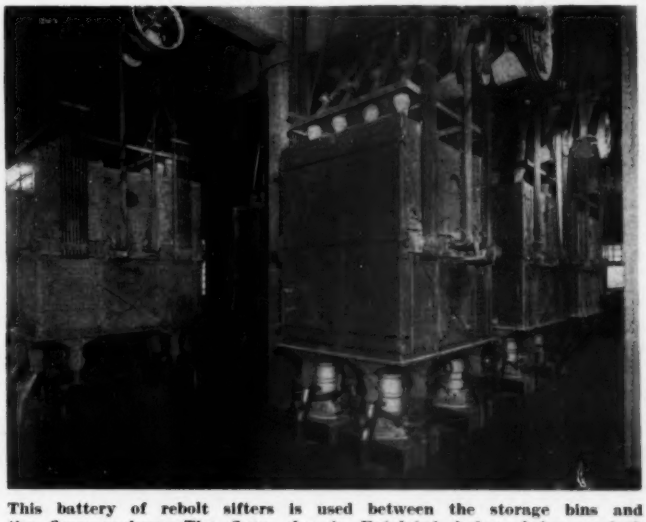
The network of feeders located beneath the bulk storage bins accurately measure the proportions of flour fed into the stream.

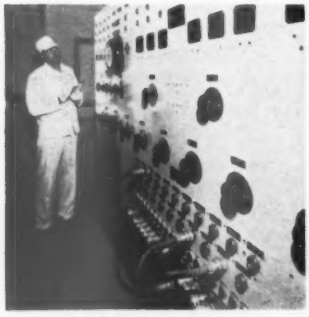
Sacked flour is transported on an overhead conveyor belt from the packers directly to the boxcars on the railroad siding.

This picture shows the exterior of the nine-story tall bulk storage plant of the Commander-Larabee Milling Co. at Kansas City, Mo., adjoining its Monarch Mill.

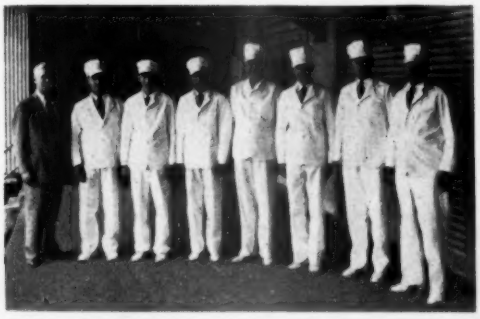
This picture shows the floor on top of the bulk storage bins. Telescoping spouts deliver the flour from the overhead conveyors to the bins.



This battery of rebolt sifters is used between the storage bins and the flour packers. The flour also is Entoleted before being packed.



All equipment is interlocked through the master control switch panel shown in the picture above.



Left to right: C. F. Hilts, in charge of operations; Don R. Rehwaldt, E. D. Crockett, Sam W. Mollett, John Rich, E. L. Weld, L. R. Warren and Roy C. Kilmer.

An air-conditioned products control laboratory is one of the features of the new bulk storage plant. Shown above is a portion of the laboratory.

Control Physical Hazards with Guards on Machinery

By Roland P. Blake
U.S. Department of Labor

THE only sound approach to the control of physical hazards, particularly the safeguarding of machinery, is very simply stated indeed. We must reduce the factor of hazard to the lowest practically possible minimum. Making the machine or tool or workplace safe enough so that a reasonably careful person can avoid injury is not an adequate goal. It is not good enough. We must make it as difficult as possible for him to get hurt.

Careful analysis of typical individual accidents will quickly bring justification for this approach. In every case (barring the so-called "acts of God") such analysis will reveal two basic causative factors, that is, **hazard** and **faulty behavior.** Two or more elements of each of these two basic factors are usually involved in each accident, but both of these basic factors are always present in some degree. A little clear thinking will show the reason for this fact.

Hazards of themselves do not injure people. One must place himself (or be placed) in contact with the hazard or injury does not result. A pair of unguarded gears does not reach out and grab the victim. Instead he (or his clothing) must come within the sweep of the teeth. A slippery spot on the floor does not trip one. It merely fails to hold the foot placed unsurely upon it. Thus we must have the factor of hazard, a chance to get hurt, and unsafe or otherwise faulty behavior, the action factor.

Obvious though this reasoning may appear, I believe it of extreme importance to stress it because of a widely advertised, and I am afraid widely accepted, fallacy that can have only resulted from superficial thinking. I refer to the use of a ratio to express the relative importance of unsafe conditions and unsafe acts in causing accidents.

Much time and effort has been spent by various groups and individuals to establish this ratio. It is commonly given as 85% or 90% of all injuries due to unsafe acts and only 10% or 15% due to unsafe conditions.

While one of the studies in this field (that made by an American Society of Safety Engineers committee) attempted to take into consideration the combination of both factors, the more widely quoted study, that of Heinrich (a monumental job covering 75,000 accident reports), did not. In this study only the condition or act that was deemed to be the major causative factor was taken account of. All other causative factors were ignored.

It seems to me that the concept itself of establishing a ratio to express the relative importance of unsafe condition and unsafe action as causative factors is unsound and fallacious. First of all a ratio indicates relative importance. But who can say which is more important, hazard control or the development of safe behavior? Both are essential.

Secondly, such a ratio established for industry in general would apply to any given plant or operation only by pure chance. It does, however, furnish a beautiful excuse for those who are unwilling to face the hard work involved in painstakingly searching for and rooting out the hazards, and coincidentally working out safe work methods and systematically training the entire working force in their use.

Reliable and adequate causative information is obtainable only through prompt and thorough accident investigation by competent per-

EDITOR'S NOTE: The accompanying article is the text of an address delivered at the recent National Safety Conference by Mr. Blake. He is principal safety engineer, Bureau of Labor Standards, U.S. Department of Labor.

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sons. Such investigation is not the practice in the establishments from which the overwhelming majority of our injuries come.

Two factors, physical hazard and faulty behavior, are necessarily present in every case of work injury. Therefore, the only sound approach is to adopt and consistently follow a policy of reducing and keeping the hazard factor to the lowest possible minimum and with similar thoroughness prosecute the development and maintenance of safe and adequate behavior by everybody at all times. This is the policy followed by the leading establishments whose names have become synonymous with low injury rates. Best safety performance, measured in terms of injury elimination, can be had on no other basis.

Some of you, having in mind conditions in your own plants, may wonder why I emphasize the physical hazard thing. The answer is simply that throughout American industry in general, far too little attention has been given to hazard reduction. Unless you get into a very wide range of establishments in the various branches of industry you do not know how wide the breach is between the performance of the more backward half of the nation's industry and that of its leaders.

Any of us could name a few employers whose performance is so good that it approaches perfection. Any state safety inspector could show you that in the great majority of this nation's work places great gains could be made for safety by better hazard control. He could also show you numerous establishments in which even the rudiments of safety are completely ignored.

The 85%—15% fallacy is a serious deterrent to improvement in the segment of industry where improvement is most needed. The managements who aren't doing a good job of hazard control see no reason why they should if 85% or 90% of all injuries are due to unsafe acts. Would you if you really believed the ratio?

First in the methods and techniques of hazard finding, of course, comes planning. In any new undertaking hazard elimination should be a major purpose from the earliest stages of the planning. It is surprising how many hazards can be eliminated through informed foresight in the planning stage.

Unfortunately, few architects know much about accident prevention because it was not included in their college courses. Some engineers who design plants and plant layouts do a good job of it, but the majority don't, because they didn't get it in college either.

As a result, the usual practice is still to design a building that will house the operations reasonably well, fill it with equipment that will perform the necessary functions at reasonable production rates and costs, and leave most of the safety problems to be wrestled with later by operating personnel, who are under pressure to produce and seldom have much real knowledge of hazard elimination.

If at this stage a safety engineer is employed his hands are largely tied by the mistakes and omissions in the planning stage. So he does the best he can to build defenses of safe practice and safety consciousness around the hazards. How much better it would be to start with hazard elimination and develop safe practice in addition to it rather than in place of it.

With a plant in being, planning can apply to changes, alterations and rearrangements. Over a span of years these can sum up to an important total, but they can never take the place of pre-planning.

Hazard inspection was all important in the early years when we were learning the hows of hazard control. Unfortunately, many managements found themselves with over detailed, too time consuming inspection systems and curtailed them too much. There is a reasonable middle ground. Every management will find that a systematic inspection system suited to its needs will find most of the continuously developing hazards of an operating establishment before they yield their unhappy fruit of employee injury. Most large plants have such inspection systems; few small ones do.

Now we come to job safety analysis as a means of finding the hazards. Its great effectiveness in developing safe work methods and safe job practice has tended to obscure its value in finding the hazard points. Actually job safety analysis, if competently and thoroughly carried out, is extremely valuable in hazard reduction, because it brings the hazard points to light so that maximum attention can be given to their elimination or reduction. Its value for this purpose can hardly be over-emphasized.

Finally we come to our accident post mortem—accident investigation. If we investigate each accident thoroughly and competently with the dual purpose of finding and evaluating the hazard factors, as well as the behavior factors and, if we do everything possible to reduce the hazard factor we are making progress.

In this as in all other phases of our programs, we should remember that hazard reduction represents a positive enduring gain, while safe behavior, necessary as it is, is still

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an undependable thing that may waver or vanish without warning. It is never a satisfactory alternative to hazard elimination but should always be striven for as an additional essential.

It seems silly to point out that hazards never correct themselves. Yet failure to take prompt action to correct each correctible hazard as it is brought to light is so frequently found that the above emphasis of the obvious is fully justified. "We leave undone those things which we ought to have done" could well be the the self humbling statement of a great many managements.

I suspect this slowness to apply positive means of hazard correction is at least partly due to our disreputable friend, the 85%-15% fallacy. An executive who thinks in terms of the 85% will give little thought to hazard reduction nor will he be inclined to spend even moderate sums on it.

I would like to find a better term than "guarding" to use in connection with reducing the factor of hazard in the operation and servicing of machinery. A guard is a gadget or device or barrier you add in order to protect people against a hazard. It does not reduce the hazard. It merely erects a barrier in front of it. If it fails or is removed the hazard is wide open again.

The only sound approach is to put hazard elimination first and leave to guarding only those hazards that cannot be eliminated through design or otherwise. While there are some exceptions, the prevailing practice can properly be described as "afterthought guarding." That is, most machinery users buy a machine that will perform the required operations for the lowest competitive price. When he gets it he adds whatever guard he thinks is needed or he waits until a state or insurance inspector calls and tells him what guarding is required. In other words the prevailing practice is to guard as much as is necessary to comply with legal or insurance requirements.

Instead the basic philosophy should be to reduce the factor of hazard to the minimum first, leaving only the uneliminatable hazards to be protected by guards. All guards should be included in the machine design to be functional parts of the machine, not contraptions added afterwards.

Some of you may think that the matter isn't important. You may believe the often heard statement that so small a proportion of the total worker injuries is chargeable to machinery that the matter isn't very important. If you think so you are wrong unless you also consider unimportant a total of some 250,000 to 300,000 disabling injuries per year, of which from forty to fifty thousand involve permanent partial disabilities with several hundred permanent disabilities and deaths.

These figures are based on the analysis of the overall reports of compensated injuries from several leading industrial states. They may be either low or high but they certainly aren't wild enough so that the accurate figures, if they were obtainable, would make the volume of injuries chargeable to machinery look relatively unimportant.

The proportion of machinery injuries that could be prevented by better safeguarding, or rather the number that should be charged to the failure to correct correctible hazards through safer design, better guards, and the like, can only be guessed at. However, the author has studied this condition through many years by the analysis of accident reports supplemented in a very substantial number of cases by the findings of carefully detailed accident investigation.

I have also discussed the matter with many firing line safety engineers, whose work takes them into a wide range of establishments. It is my considered opinion that at least half of all injuries chargeable to the operation and servicing of machinery could be prevented by better safeguarding, that is by changing the prevailing practice of "afterthought guarding" to one of "forethought safeguarding."

It has been realized for a long time that the situation is very unsatisfactory. ASSE, for at least 20 years, has had a committee charged with the "Promotion of guarding machinery at the source." The International Association of Governmental Labor Officials has had a similar committee for at least a dozen years. Some of the states have tried to meet the situation within their own borders.

Little has been accomplished because the diversity and magnitude of the various problems involved are far beyond the capacities of any single agency, group, or state. It is apparent that a well organized, nationwide program in which all the various interested groups join forces, is essential if satisfactory results are to be secured.

Accordingly, the Engineering Committee of the President's Conference on Industrial Safety asked the Industrial Conference to take the leadership in the development and prosecution of such a program. The Industrial Conference received this request favorably and appointed a committee with Dr. Yant as chairman to work it out. Promising progress is being made.

The exploratory work done by the ASSE and IAGLO committees, and by the Bureau of Labor Standards at the request of the IAGLO committee, emphasize the following factors.

1. Machines should be fully safeguarded by those who design and build them because:

a. The manufacturer of a machine knows best what his machine will do and is in a better position than anyone else to design it and guard it for the maximum in safety and practicality.

b. Design is of such vital importance to safety that certain machines, as for instance the ordinary circular (table) saw, cannot be properly guarded unless the machine and the guarding are designed for each other; that is, the guarding must be built in.

c. In general, a satisfactory guarding job built into a standard model will cost not over half as much as similarly effective guards (if equal effectiveness is possible at all) added later.

d. "After-guarding" rarely looks right. A guard should be as well built and look as good as the most finely finished and carefully made part of the machine. A cheap looking guard on a machine is not giving safety the respect that is due it. How can either workmen or foreman have much faith in an attitude toward safety that puts a rough looking, home-made guard, or any "afterthought" guard on a finely finished new machine?

e. Probably most important of all is the fact that a very large proportion, probably a large majority, of the common hazardous machines go to small establishments lacking

safety viewpoint, and who, moreover, have at best infrequent contact with men experienced in the safeguarding of machinery. Were standard models of these machines fully safeguarded in the process of manufacture, this condition would be greatly improved. It has already been done with the common type of pedestal abrasive wheel.

2. Discussion with a number of machinery manufacturers have brought out the following points:

a. Manufacturers are generally willing to cooperate with any practical program to get safer machinery and equipment, but are largely governed by consumer attitude.

b. Consumer interest in fully safeguarded models must be stimulated. At present, with most, safety is an afterthought. Few orders include guarding. Purchases are mostly on a basis of prices without guards.

c. Consumers can be reached through state inspection, publicity in trade and safety journals, trade associations, and through their insurance carriers.

d. Definite detailed standards and specifications to guide manufacturers are needed.

From the studies made to date, it seems clear that if manufacturers are to adopt generally the policy of safeguarding fully the machines they produce and selling them on that basis, certain conditions must be provided. These seem to be:

a. State codes, standards, or other requirements on which approvals or acceptances are based, must be free from conflicts.

b. Standards and specifications for safeguarding must be sufficiently complete to serve adequately to guide the manufacturer in designing and constructing the safeguards.

At the request of both the Engineering Committee of the President's Conference and the IAGLO Committee on Machinery Safeguarding the Bureau of Labor Standards is making a detailed analyses of the machinery codes of the various states in order to bring the conflicts to light. The findings are being transmitted to the IAGLO, which is prosecuting a program of eliminating them.

The following appears to be a reasonable summarization of the situation:

Consider the User

User safety should always be a vital consideration in the design and manufacture of any machine. Not only should the manufacturer build the maximum of safety into the machine he produces, but point-of-operation guards should be considered vital parts of each machine and be designed and constructed to function as effectively and as long as any other part of the machine. Standard models and prices should include guards.

While the manufacturer must meet his customers' wishes and can manufacture only that which he can sell, he can and does habitually do much to guide the judgment of his customers. Some manufacturers are doing excellent work along these lines to advance the cause of safety, but in the main they have not yet realized the important part they can and should play in building safer machines and fostering the demands for them. The problem is basically one of consumer demand. The great majority of machines are ordered with little or no thought of the safety of the operator; or, if his safety is thought of, the purchaser expects to apply any needed guards later.

A-C to Feature Three Machines at AOM Convention

MILWAUKEE—Three units of latest designs in Allis-Chalmers' flour milling equipment line will be featured by the company at the milling machinery exposition to be held as a part of the annual convention of the Association of Operative Millers May 14 through May 17 at Hotel Sherman.

The A-C exhibit will include a 4 by 17 free-swinging sifter in operation; a 9 by 30-inch double "AirSet" roller mill, and an all-meal purifier.

The sifter is of strong maple and birch construction, is equipped with steel cables in addition to the wood suspension reeds, sanitary bottom pockets, easy-to-clean bottom board, and ventilated hold-down box.

The "AirSet" roller mill will have its first public viewing at the convention. The machine features pneumatic control of the rolls. The purifier has one-piece sieve construction, completely enclosed driving mechanism, double anti-friction bearings, and individual motor-driven reversible brush screw.

Sanitation in design is stressed in all of the modernized A-C flour milling equipment.

Among those from the A-C grain milling section expected to be on hand at the convention are H. K. Swan, manager of the section; J. L. Neenan, H. L. Beebe, H. D. Vanderlip and Harvey Reinhard, all of the Milwaukee office; D. H. Lory, Norwood; H. E. Rountree, Buffalo; H. H. Stark, Oklahoma City; C. F. Dawson, Minneapolis; F. H. Strickland, Kansas City; O. V. Tally, J. C. Collier and D. F. Wilson, all of Chicago, and S. E. Bovim, Peoria, Ill.

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Leased and operated by Simonds-Shields-Theis Grain Company, the Rock Island Elevator is one of the largest terminal elevators in the Mid-West. It has a storage capacity of approximately 4,000,000 bushels of grain and covers a site of over 1¾ acres. Annual movement of grain through the elevator is 8,000,000 to 12,000,000 bushels per year.

DAY Dust Control Systems were selected by the Chicago, Rock Island, and Pacific Railroad for a modernization program in its Kansas City, Kansas elevator to replace obsolete and worn out equipment. **DAY** engineered, fabricated, and installed eight complete dust control systems in addition to six-track receiving hopper units which control dust when grain is received from railroad cars. These **DAY** Dust Control Systems were installed throughout the A, B, C, and D houses of the elevator.

Efficiency, economy, and dependability governed the selection of **DAY** Dust Control Systems for controlling the dust at all belt loading points, belt transfer points, elevator boots, movable trippers, scale turnheads, and other points where dust is created. All systems are then properly trapped so that whole grain is taken out of the airstream before coming to the industrial exhausters. These **DAY** Dust Control Systems assure a cleaner elevator with a minimum of explosion hazards.

Dust Control for Every Size Plant

The **DAY** Dust Control Systems described in this advertisement were designed and installed to meet the specific needs of the Rock Island Elevator. **DAY** engineers are at your service, too—whether your plant operation is large or small—to give your dust control requirements the same personalized attention.

Put Your Dust Control Problems in *Experienced* Hands

Since 1881, the **DAY** Company has specialized in engineering, manufacturing and installing dust control systems for mills and elevators. No other dust control manufacturer can even approach **DAY'S** vast range of experience in this specialized field. Regardless of your dust problems, **DAY** can provide an effective and economical solution. For engineering assistance and cost estimates—Write-to-**DAY**.

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Tips for Supervisors

Handling the Worker with a Gripe

By Edmund Mottershead

I ONCE knew an old-time supervisor in a shoe factory who kept a baby's bottle with a nipple on it in his desk. Every time he heard of his employees grousing and griping, he would say nothing, just get out the bottle and stand it silently on the worker's bench. There would be a general laugh, and that was that. However, the success of his little joke was in his years of complete understanding of each man under him. Many of the men had been with him 15 or 20 years, and they were all good friends at heart.

That friendly spirit and well developed understanding unfortunately does not exist in many departments in many plants. Workers who have been on the job for three or four years are considered old-timers. Supervisors have held their responsibilities in some cases only a relatively short time. The hurly-burly demands for more and more production has put new pressures on all supervisors and executives, and many of the normal amenities of life have been bypassed.

Complicating the picture still further, organized labor has, in some cases, taken advantage of conditions to enforce wage levels and conditions of employment which have in some instances made it difficult to maintain a direct personal friendly relationship between supervisors and workers.

In the midst of these larger problems, "gripes" often get little attention from management. This, of course, is short-sighted. A man may fear losing his job and still have a gripe which seriously affects his productivity and usefulness as a worker. Just as oaks grow from little acorns, grievances, labor disputes and strikes grow from gripes which are not handled properly at their source. A labor relations consultant tells the story of a company which suffered a three-month strike, costing it well over a million dollars, the dispute springing from a seven-year-old gripe in the mind of an employee who did not understand a new payroll basis and thought the company had cheated h m out of $17.

People are not controlled primarily by reason or judgment or thought. They are dominated and activated by their emotions, their feelings. Groups of workers form attitudes toward management, toward working conditions, toward each other, toward their bosses, largely on the basis of their feelings and prejudices, their likes and dislikes.

Management must never forget that the basis for most of the friction, discontent, gripes, and real grievances encountered by supervisors in the plant is simply the way workers feel about things.

Suppose you walk into your office one morning, and you are greeted with: "Boss, it's 95° in here!" All you have to do is check the thermometer to find out if he is right. On the other hand, suppose that later in the day one of the men comes in from the shop and says, "It's too hot in here!" You show him the thermometer which says 65°. His inner reaction, whether expressed or not, is simply, "So what? Sure it's 65°. It's still too hot!"

It's not a question of intellect. You both agree as to the specific temperature. His statement is simply one of feeling . . . for him it is too hot. Apart from himself as an individual, the relative idea of too hot or too cold is meaningless. As a part of him, it becomes a gripe and a possible grievance. You cannot satisfy him until you change his feeling, not by changing the temperature.

A gripe springs from any condition or combination of conditions which may make the worker dissatisfied. It may be real or imaginary; It may be based on a lack of knowledge on the part of the griper. But, in any case, as far as the griper is concerned, he has a real grievance, and his problem must be handled as such by the supervisor.

Gripes and eventual grievances usually spring from one or more of three sources: conditions within the individual worker, conditions inside the plant and on the job, and conditions outside the plant in the social life of the individual.

As far as **conditions within the individual worker** are concerned, they cover the whole range of personality. His age, strength, and intelligence will have a direct bearing upon the success with which he performs his job and adjusts himself to his job

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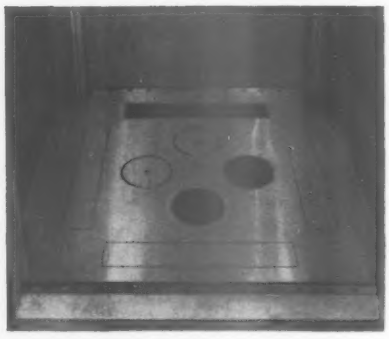

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Allis-Chalmers free-swinging sifters are available in two, four and six sections with 12, 17, 22, or 27 sieves in each section. Get full details from any A-C sales office or write direct. Ask for bulletin 06B7180.

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- Free flowing—uniform feeding—excellent dispersion.
- Uniform, finer particle size of ingredients and carriers provides more uniform flour enrichment.

For Better Flour Bleaching

Oxylite®

Offers These Advantages

ECONOMY— bleaches flour safely to any desired degree of whiteness with much less than is needed with other, less efficient bleaching agents.

UNIFORMITY— of particle size, benzoyl peroxide content and bleaching action of each particle, results in uniform flour whiteness.

QUICKER BLEACHING— faster color removal allows close manufacturing control.

EFFICIENCY— due to unique manufacturing process (U. S. Patent No. 2,460,439).

NO SPECIAL EQUIPMENT REQUIRED —can be used in your present equipment.

PERFORMANCE FACTS— Leading national millers have endorsed the efficiency and economy of Oxylite. Letters in our files state that substantially less Oxylite than other bleaching agents is required to obtain optimum color removal. This money-saving Oxylite performance is being repeated daily by millers throughout the country.

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environment. Race, creed, nationality, religion, health, personal deformities, height, and even weight can bring about feelings of inferiority and conspicuousness, and other personal reactions which generate irritation and insecurity within an individual. His own viewpoints and prejudices, sentiments and aptitudes, his possible lack of emotional control, all add to the chances of irritation and dissatisfaction springing from his own personality. These, of course, are not inherently sources of grievances; they simply provide an opportunity for other conditions to become gripes as they affect his own personality.

Conditions inside the plant and on the job which can give rise to gripes include hours of work, vacations or lack of vacations, working conditions, sanitation, light, ventilation, the people the worker must associate with, wages and advancement, the social recognition given the job he performs, lack of understanding on the part of a supervisor, failure to get recognition for suggestions made, failure to have promises made by supervisors kept. Many gripes and grievances arise from irregularity of work, the element of distaste for certain unpleasant jobs, the personal friction which can build up between divergent personalities working at high speed and under pressure in close quarters, and seeming favoritism shown by the boss in job assignments.

Conditions outside the plant in the worker's home or social life are equally important in creating dissatisfaction in his mind. His job may not bring him enough income to measure up to the standard of living of his friends. It may be looked down upon by his friends, or by his wife and her family and friends. It may make him work such hours that his home life is disrupted. Where women are working, children may go without proper care. Pleasures and frustrations, drunkenness, economic uncertainty, the general insecurity of life, worry about the atom bomb, all may contribute to his own uncertain emotional state.

When a worker has a gripe, he usually takes it out in one of four ways:

1. He complains openly in words;
2. He does his work less effectively;
3. He may on occasion adjust himself satisfactorily without aid;
4. He may worry and brood silently over the thing until it becomes an obsession.

One thing is certain: if a worker is worrying or working at less than his normal efficiency, the worry is affecting his health and there is not the best relationship between worker and supervisor. The supervisor can do much in the way of finding out what the worker is thinking and what his personal home conditions are simply by showing a sincere and friendly interest in the worker as an individual, entirely without being nosey or prying.

Whether the gripe becomes a grievance, and where it eventually lands, depends largely upon the supervisor. Depending upon whether the gripe gets to the supervisor, the union representative, other workers, or to the front office, a variety of things might happen. The supervisor is really the key man in the situation. If he has already built up a good, friendly relationship with his workers, they will naturally come to him.

Sometimes the gripe or grievance exists for a long time in the worker's mind without being made known or being recognized by management. This may be due to a fear of being discharged on the part of the worker, to his natural timidity, or to the fact that he may be secretive by nature. In addition, some men are so constituted that they can stand more without letting it get them down. The fact is that these unexpressed gripes are usually far more serious in the long run. The emotions of the worker react upon his thinking, and eventually the gripe turns into a grudge against the company or against his boss.

There is no single technique for handling gripes, but several methods have been developed by trial and error which might prove useful:

1. **Get the worker's viewpoint,** and be considerate of it, whether the gripe is real or imaginary. This convinces him that at least (and at last) you are trying to be fair with him. With this, you need a really sincere desire to help the man with his problem. Patience, always being willing to hear a story and consider a complaint, in itself eliminates one major source of gripes—"not being heard."

2. **Remain calm and objective.** Make it as easy as possible for the worker to state his case and for you to get the whole story and determine the actual root of the trouble. The "problem solving approach" keeps the conversation on the basis of a friendly discusssion, mutually getting information and trying to solve the problem. Keep the heat off to get cooperation.

3. **Get all the facts** before attempting any solution. This prevents accidental unfairness to other employees, gives the worker with the gripe a further chance to talk himself out of

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it, and gives you more time to think. By avoiding snap judgments, you create the impression that you have an open mind, and are giving the worker due and serious consideration.

4. **Save his face.** It is essential for the complainer that he preserve his own self-respect. It will also encourage him to come back later if dissatisfied, instead of nursing his grievance to himself. Be willing to admit your own mistakes. This sets a good example and also convinces the others of your own fairness.

5. **Be prompt in reaching a decision.** This convinces the worker of your interest in his welfare, and makes your own task easier. However, don't make any promises you don't intend to keep. If you get caught at that, the deal blows up!

6. **Avoid using the force of your authority** to reach a settlement. The problem solving approach of mutually working out the answer makes the worker feel that the decision finally reached is at least part his own idea. Remember the old jingle: "A man convinced against his will is of the same opinion still."

7. **Avoid passing the buck** to superiors or to other supervisors. It not only breaks down your own self-respect, but also the respect your men have for you. In addition, passing the buck up the line crowds the people in the front office, who have plenty to do rather than handle gripes which are your responsibility.

8. **Keep the channels open** for appeal to higher authority if the worker wants to do so. This gives him the feeling that you have been honest and sincere in your approach to his problem, and leads to better all around labor relations, when workers feel that they are not at the whimsical mercy of an unsympathetic and ununderstanding boss.

Five thousand years ago an ancient Egyptian named Ptah-Hotep wrote: "If you are in the position of one to whom petitions are made, be courteous and listen to the petitioner's story. Do not stop his words until he has poured out all that is in his heart and has said all that he came to say. A man with a grievance loves the official who will accept what he states and let him talk out his troubles fully. A kind word will illuminate his heart, but if an official stops the flow of his words, people will say: 'Why should that fellow have the power to behave this way?'"

According to Glenn Gardiner, "There's dynamite in neglected or indifferently handled grievances. Poor handling of grievances is doubly dangerous, because an accumulation of little irritations and aggravations to which no one pays much attention can finally swell up and burst. Truly it has been said that most fires could have been put out with a teacupful of water applied at the start."

Grievances and gripes are nothing new in human relations. They are as unnecessary today as they were 5,000 years ago. Their elimination depends upon the alertness and understanding of the supervisor who is big enough to discharge his full responsibility in handling them.

——BREAD IS THE STAFF OF LIFE——

Mold Process Reduces Cost of Manufacturing Industrial Alcohol

Industrial alcohol can be produced from grain by a new mold process at less cost than by the traditional malt process, the U.S. Department of Agriculture reports.

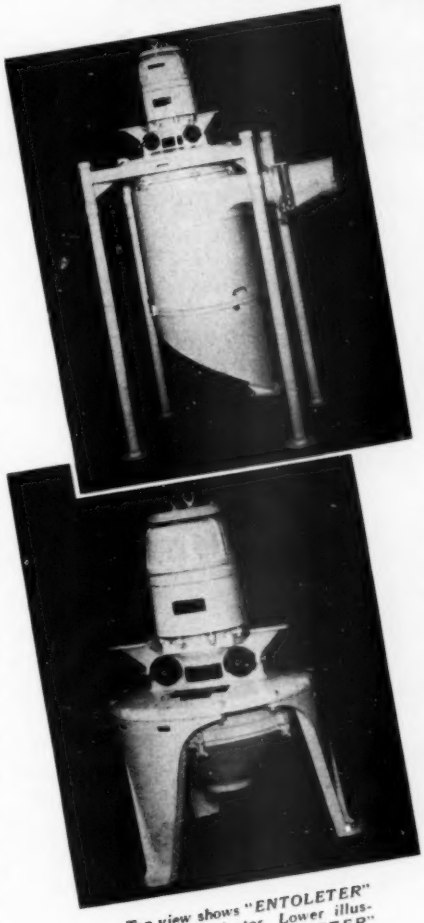
A plant using 12,000 bu. of grain a day could save more than $1,000 in each day's operations by shifting to the new process, which uses a mold product called fungal amylase in place of malt, the department says.

A full report of these tests is being issued by the Grain Branch of the department's Production and Marketing Administration. The new fungal-amylase process was developed by the Bureau of Agricultural and Industrial Chemistry, which cooperated in the commercial trials. Bureau scientists first worked out means of using the mold enzyme to replace malt on a pilot-plant scale at the Northern Regional Research Laboratory in Peoria, Ill., and then aided PMA in supervising large-scale tests of the process, which were carried out at the Iowa plant under authority of the Research and Marketing Act of 1946.

PMA and BAIC conclude on the basis of these experiments that use of fungal amylase is practical when certain additions and alterations, chiefly of a minor nature, are made in distillery equipment and procedures. Research at the Bureau's Northern Laboratory to further improve the process is continuing. However, the tests reported so far show that yields of alcohol with fungal amylase from either sound or heat-damaged corn are at least equal to yields obtained when malt is used.

A detailed description of the process and equipment used in producing grain alcohol with fungal amylase and a complete report of the Iowa experiments are contained in Technical Bulletin No. 1024, "Methods and Costs of Producing Alcohol from Grain by the Fungal Amylase Process on a Commercial Scale," now being printed. A copy will be available, upon request, from the Information Branch, Production and Marketing Administration, U.S. Department of Agriculture, Washington 25, D.C.

More and More this is the Way Millers are Getting Continuous Insect and Fragment Control



Top view shows "ENTOLETER" Scourer-Aspirator. Lower illustration shows "ENTOLETER" Insect Destroyer.

Modern mill sanitation requires *continuous* protection from insect infestation and insect fragments. Quoting from a recent article:

> "A number of conclusive tests have shown that the wheat stream is the major source of fragments in freshly milled flour. It is a particularly elusive source because it is not often possible to distinguish a perfectly sound kernel of wheat from one which contains insect life. Generally, wheat is fumigated between harvest and milling. Insects in their various stages of development are thus destroyed inside the kernels. After drying out in a comparatively short time, they readily break up into small pieces when subjected to the milling processes.... Many mills have found that an alarmingly high percentage of the wheat is infested internally."

Insect fragments are a constant menace to the quality and reputation of flour and other milled products. To protect your products from this danger use the *continuous* control of "ENTOLETER" Centrifugal Machines. The combination proved best for continuous control of infestation and insect fragments is the "ENTOLETER" Scourer-Aspirator, now successfully used for grain cleaning, and the "ENTOLETER" Insect Destroyer to protect flour streams, blending stocks and the finished product before packing.

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CENTRIFUGAL MACHINES
CONTINUOUS INSECT CONTROL SYSTEM

British Viewpoint

Flour Milling—An Art or a Science?

By Dr. J. Williams

A PROFESSIONAL friend of mine in a lecture delivered to chemists some time ago, made the statement that "Flour Milling is still an art." This remark implied that a change was taking place in flour milling; that it had been an art in the past, that it was still an art but that there was a change going on or a possibility that at some future date flour milling might develop into something else other than an art.

Looking at the history of flour milling, there have been changes and development in many ways. Nature intended wheat and other grains to be a means of maintaining its own species. It is seed with all the properties of a seed: a reproductive section—the embryo or germ, a food store for the developing embryo—the endosperm and a wrapping to keep the two sections together and as a protection for the seed until it is ready to fulfil its natural purpose—the bran. These are all connected together into a composite whole and each part is difficult to separate, as present day millers all know from experience. Man found that these seeds could be used as food for himself and other animals. They had a nutritive value. Animals can eat the grains as they are, but man needs to crush them into some sort of meal and he makes the resultant meal into a loaf or cake or a porridge. There have been changes in the method of production of meal from wheat over the centuries—the pestle and mortar, the quern, cattle mills, mill stones driven by water and wind. All these produced a meal in which the whole of the wheat grain was found—a wholemeal or wheatmeal.

EDITOR'S NOTE: The accompanying article was adapted from the text of an address presented recently by Dr. J. Williams of E. R. & F. Turner, Ltd., British milling equipment firm, before a meeting of a group of flour milling students in Sheffield. The article appeared originally in Milling.

Then civilized man created taste and started to separate some of the coarser outside husk or bran which his digestive system could not assimilate and produced a slightly more refined meal. He found that by bolting or seiving this meal, he could obtain a white flour which looked better and produced something more pleasant to eat. Around 1880 millstones began to give way in this country to roller mills and the present day process of gradual reduction milling was started on its way.

All this was a development in method of production—a change in machinery of production, a change in objective in so far as the type of flour desired followed developments in civilization.

When the Family Was the Unit

There has been development and change in the unit of production, a change again which has been a result of developments in civilization. In the first place, the unit was the family and grain was ground to meal by primitive means in small quantities sufficient for the family or possibly for the tribe. As villages grew, mills grew in size and served a single village. With the Industrial Revolution, concentration of population took place in towns and in due course units of production grew from one-sack mills to larger units of 10, 20, 50 and 100 sacks hourly capacity. Financial combines have grown in size and influence until we have our present day milling industry with its mixture of combines and privately owned mills, large port mills and small country mills. All this has altered the size of mill but has not affected the process in any fundamental manner.

In common with many industries, there has been a fundamental change in outlook within the last 30 years or so. There has been a realization that scientific research can be of assistance to the industry and the setting up of a central research organization for the milling industry.

Before examining in more detail what have been the effects of the impact of science on milling, let us look into the significance of these two terms, which seem to be taken to be so much at variance, and to

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Naturally you want your self-rising flour to keep well. You want it to bake even better than the quality of the flour warrants, if that's possible. And you want the oven products to have the natural, wholesome, *good flavor* you've milled into the flour itself.

This being the case, you'll be guided by Victor's 54 years of experience in developing leavening ingredients for self-rising flour. You'll pay special attention to V-90 . . . the *ideal* leavening with the *long* life. You'll look at V-90's record of 12 years of making *any* self-rising flour keep longer and bake better. You'll remember that V-90 is the ideal leavening that improves the flavor of oven products. Then you'll find that practically all of the self-rising flour made, contains V-90 and you'll say . . . "V-90 is for me!" *That* makes sense!

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define the occupants of two opposite camps.

Accepted Definitions

There are two accepted definitions of Art. In the first place, art refers to the doing of a thing as opposed to the knowing of a thing; this latter would be looked upon more as being the field of science. A more vague and embracing definition includes under the term art all that is not done by man in the way of utility, i.e., for luxury or pleasure. These two definitions are met with in everyday life. Art as applied to painting, sculpture, decoration, involving forms of design and arrangement, music, drama, etc. It is a form of presentation.

I think the definition given in the Encyclopedia Britannica includes all the implications and variations when it states that art implies skill and ability, acquired through patient practice and directed towards a definite end, either aesthetical when we have the fine arts, ethical covering arts of conduct or useful—the liberal arts.

The practical side is emphasized throughout and frequently the rules are empirical—a matter of experience and observation by the senses.

How Science Differs from Art

Science is a term which seems to frighten and impress many people. Many things are laid at the door of science—some good, some bad. What, then, is science? How is it different from art? It is applied to systematized knowledge — knowledge arranged under general truths and principles. Some people apply the term science to the study of abstract principles as distinct from art, which is concerned with practical aspects. There is no doubt that science involves thought but most branches involve action as well, either in the application of principles discovered or in the experimental verification of ideas or the discovery of truths. It is probably the aspect of thought which defines the scientist as much as anything else. Science involves the classification of facts and the recognition of their sequence and relative significance and it includes all systemized thought. Its scope is the ascertaining of truth in every branch of knowledge. Its method is the accurate classification of facts and observations of their correlation and sequence. It involves the discovery of laws and above all a measure of self criticism. In short, the scientist arranges everything in the correct perspective by concentrated thought. But lest it be thought that the scientist is someone with no practical sense of values—the type of person depicted as the absent-minded professor—let me say at once that science has its practical side. One has the experimental science.

"Scientists," "research" and "technical experts" are the terms which have been increasingly introduced into industry and in their turn they have come into the milling industry. Chemists have been employed by milling concerns and consultant chemists have served the industry continuously. Research work has been performed in the laboratories of the industry at St. Albans and published over a number of years as reports to the members and in scientific journals; various factors in milling have been investigated and more apparatus introduced into the mill. What has been the effect of this impact of science on the industry and on its methods? What changes, if any, have come in its wake? Has it changed milling in any way?

The answer must undoubtedly be "yes" to some extent, but we must look carefully to see the full extent of this entry of science. One thing which distinguishes art from science is the attitude towards spreading knowledge. The scientist searches for truth and having found the truth he publishes it for all and sundry to know about. Apart from the credit and satisfaction obtained from being able to tell the world that he has discovered something, the scientist wishes to add all he can to the pool of knowledge. He realizes that it is a waste of time and effort to search for something which has already been found.

Wherever sicentists get together they discuss their problems and publish the results when free to do so. This applies to knowledge. Loyalty to one's employer will obviously limit the giving away of secret information regarding technique, etc., to one's competitor, but on balance there is everything to be gained from a free interchange of ideas. One hears much these days about atom bomb secrets and feelings are expressed by scientists concerned that such information should not be withheld from other nations. This attitude is not due to love of communism or lack of patriotism; it is the inherent desire of the scientist to share his knowledge with others in the same field of endeavor, to compare notes, discuss problems and take advantage of the common store of knowledge.

The Impact of Science

The impact of science in flour milling has brought in its train a similar outlook. It had to come before research could be of any value to the industry. In an art, there is a tendency for undue mystery regarding

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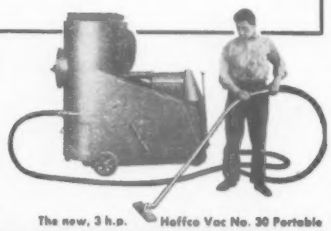

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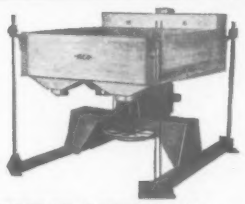

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the process—a mystic shroud of secrecy, with the secrets handed from father to son. In many cases such knowledge was handed on by word of mouth and not committed to paper. I have been in establishments where "secret rooms" were in being and where the entry of "strangers" appeared to be signalled to the manager's office. Science or scientific method can be of no use under such conditions. One of the biggest benefits of the scientific impact has been this revolution in attitude which permits millers to open the doors of their mills and their minds and discuss their problems one with another. The advantage of this change of heart was noted especially in connection with high extraction milling during the war. Interchange of ideas on milling between miller and operative in their own mill and between millers and operatives whenever they may meet outside can only lead to all-round improvements.

The scientist has given the miller new words in his vocabulary and a new language. The first task a new research worker has to do is to assess the stock of existing knowledge and then plan his method of attack.

A New Language

The first task was to define existing conditions. Wheat was milled successfully and flour was being produced by millers, but the conditions under which wheat was being milled were not defined. Experience had shown a particular miller that wheat would keep if it was dry and the state of dryness was measured by plunging an arm into a body of grain or by smell and feel.

These methods gave good results with experience, and furthermore one could not describe these conditions to anyone else — they could only be shown and the other person's appreciation of the position depended in turn on his experience. In a similar way, the condition of grain was determined by bite, the degree of milling or release by appearance of the chop and the extent of grinding by feel, etc. All these methods were correct for any one person, but the reactions of the miller's thumb or his teeth cannot be sent over the phone or by letter. They are of no use as a medium of exchange. Science has brought in new methods, new standards and a new language—moisture content, percentage release, etc., to define the conditions which experience had learned. If these terms are to be of universal application and exchange, they must be determined or measured properly and research work has been done to devise methods which will give reproducible and correct results. A standard technique has to be learned before the value of these measurements can be fully realized.

Standardization

Considerable research work has been done on the factors which characterize different flours and different wheats. One of the early changes which science introduces into an industry is standardization. An attempt is made to define a product in terms of measurable quantities and, having defined the standard, efforts are made to maintain production to these limits. This is the crux of scientific production control. The customer's requirements are assessed and standard definitions laid down. Raw materials are chosen and production methods are controlled to produce the product the customer requires and as far as possible produce it uniformly from day to day.

As regards flour, moisture content has been laid down to fall in line with storage problems as well as from the economic standpoint. Ash content has been used to guide the quality and is reliable since chemical analysis and research has shown that the mineral matter is mostly located in the bran and, consequently, the mineral matter in flour is an indication of bran contamination.

Protein content has a certain value in defining a flour—weak wheats generally have low protein contents and strong wheats have high protein contents. There are exceptions to this rule but it has a general value. Maltose value is a guide to one aspect of baking quality.

The quality of gluten which classifies wheats as strong, weak or filler is an important part of the field which science has attempted to cover. Fundamental research on the rheological or plastic properties of wheat gluten has been performed and the results of such research incorporated in such machines as the Research Extensometer, Brabender Farinograph and Extensograph and the Chopin Alveograph. Such dough testing machines attempt to estimate and evaluate such functions as extensibility, spring, and to demonstrate and record on a chart some of the changes in consistency which occur in a dough. The results are easily affected by slight changes in conditions of mixing, temperature of testing, etc., and great care is needed to interpret the results obtained.

Science has thus given the miller a number of tools which are of assistance to him in controlling his manufacture. It has given him a new code, a language in which he can discuss his problems and report his results to other millers and preserve for himself a permanent record of quality and conditions in the mill.

This is the part of science which affects the student. The elements of chemistry and physics are taught him and the methods of analysis described. It is essential for the student to know the foundations of this branch of science—not for the purpose of making him into an analyst but so that he will understand the language and be able to appreciate what this impact of science really means. Chemical analysis needs knowledge of the principles involved and experience in the use of a trained technique. It involves training and even the simplest chemical analysis if the results are to be of absolute value—not just comparative value—needs a qualified trained chemist for at least its supervision. Where moisture and ash are to be used simply for control purposes internally in a mill, untrained operatives may possibly be of some value; provided the same mistakes are made every time the results may have a comparative value. But such results would not mean a thing when comparisons are made with other mills or when the results are expected to have any legal significance.

Much work has been done by scien-

tific workers which throws light on certain aspects of the milling process. The work which Dr. Jones carried out at the Research Station at St. Albans on the effect of grinding on starch cells in flour is an example of such work. He demonstrated the damage which can take place through excessive grinding and the significance of such damage to the properties of the flour—an increase in maltose value—and consequent effect on fermentation. This was a valuable piece of work with practical significance. Investigations into machine performance and into milling processes are other aspects of practical importance and assistance to the miller.

Coming to more recent times, we have the accurate dissection of the wheat kernel by Dr. Hinton, whereby the kernel has been mapped out nutritionally. The distribution of vitamins, minerals and proteins has been plotted, as it were, on a cross section of the grain. The routes which these various nutrients and sections of the grain take in the mill flow have also been followed and the results published in scientific journals and reports. We have learned much more about wheat in these past few years from the painstaking work of our scientific advisors.

Practical Effects

Science has increased our knowledge and given us a new understanding of our work. It has given us a new language and new tools. But has it affected milling? European mills, it is claimed, are run from the laboratory and in some cases production is linked to chemical and physical tests. This stage has not arrived in this country, but in most cases the assistance of the chemist is admitted. It has enabled the miller, where he so desires, to establish a standard of uniformity for himself and given him the means to verify his achievement of this standard.

The control period with high extraction milling and the insistence of the Ministry of Food and its scientific advisers on a nutritional standard of flour, have affected milling as much as, if not more than, any other impact of science on milling. Prior to this, flour was the white portion of the grain and milling was a process for achieving the separation of the white portion of the wheat from the colored.

The customer—the baker or the biscuit maker—made certain stipulations as regards quality and strength. Choice of wheats achieved this and attention to the rudiments of milling prevented damage to flour properties. Now a new value has been introduced and flour is judged by its nutritional value—iron content, vitamin B_1, or riboflavin, etc., a stipulation which sets a standard on the accurate dissection of the wheat grain to produce a product from wheat which not only looks good and bakes well but also provides the consumer with the correct nutritional factors. Science has shown how this can be done and given the methods by which chemists can estimate and analyze the flour. It has impressed a very desirable control—true quality control—and the industry has shown that the standard can be achieved and maintained.

There is, however, in milling, room for a more important aspect of science, one which all good millers have accepted and practices, and one which everyone in the industry can adopt. I refer to the need for scientific thinking. This means clear, logical analytical common sense. Earlier I mentioned that one definition of science was "the classification of facts and the recognition of their sequence and relative significance."

Modern flour milling involves some order and sequence as compared with the old days of stone grinding. A selection of a part of the wheat grain needs to be made and one can, to some respects, say that the modern milling process aims to bring order out of chaos of the first break. There are a few cardinal rules which have been set out as a result of intelligent observation. Bran and endosperm should be separated from one another as quickly as possible and kept apart; stocks intended for grinding together should be of a similar size and similar texture and quality; bran is more readily separated in large particles than as small particles or powder.

Widening Field of Knowledge

These and many others are the basis on which the present day milling process has been built up by millers. Observation of the facts and of the results of various treatments have given success and a few interchanges of ideas and discussions of problems have been of benefit to everyone. The systems have been evolved by millers—practical men who have lived with their work and thought their problems out for themselves. It has been modified and improved by numerous experiments on their behalf—experiments which have been planned scientifically and observed scientifically.

This habit of thinking, reasoning, and observing, is, in my opinion, the best contribution that science can give to the young milling student. The "facts" included in a normal course—such as the Correspondence Course for the City and Guilds Cer-

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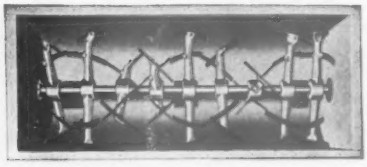

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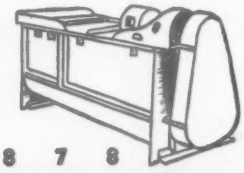

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tificate—introduce the student to the language of science and the methods employed but the introduction to the careful, logical method of thinking and observation is infinitely more valuable. Milling is a logical, orderly problem and logic and common sense are required in dealing with it. It is essential in simple observation and in simple operations as well as in the most complicated.

The taking of samples represents a case in point. The miller is always interested in examining samples of the work being done. Performance is judged by samples; they are the experimental results. But these samples are all valueless unless they are representative of the work being done.

The sample from the roller mill does not give a correct picture unless it is taken to cover the whole depth of the curtain of material as well as the length. Rejection of some of the coarser or the finer portions of the chop by taking the sample either too far in or not far enough into the roll hopper would also affect the whole nature and value of the sample.

Similarly, in taking samples of machine flours, etc., in the flow, one should avoid contamination with well separated flour, etc., which may occur if the sample is taken by just digging into the spout at a convenient hand hold at a bend in the spout. This is just common sense, you say. Quite true, it is scientific common sense, but it is remarkable the number of cases in which one sees fictitious samples being submitted.

Comparative Tests

Take again a simple operation like test sieving. If one is making comparative tests by means of hand sieving, one should endeavor to insure that the sieve plays the same part in the test each time. This can only be if the same technique of sieving is used each time, that is, a reproducible technique. It is useless to compare sieving results if on one occasion the sieve is given a series of gentle rotary sweeps—say 30 sweeps with a throw of one inch, while on another it is given a few short oscillatory shakes punctuated with a lusty tap on the side of the sieves. Just as in the estimation of moisture by the Carter Simon moisture tester, you have to bring the matter to a reproducible drill, so in sieving or in any other such operation of a similar nature, one must employ the same technique if our results are to have comparable value.

We have discussed at length the relationship of science to flour milling. We have seen the effects of the impact of the existing natural science on the industry. The chemist has endeavored to provide analytical standards for the existing processes and given an added precision to hitherto empirical methods. The physicist and the rheologist have provided a basis for evaluation of the fundamental properties of wheat—the baking quality of gluten. The accurate dissection of the histologist in collaboration with the analytical chemist has given a scientific basis for the milling process and a new standard for production. There is considerable scope for the use of scientific method in dealing with milling problems.

To come back to the title of this talk: "Flour Milling—an Art or a Science," milling is obviously not an exact science, a matter of fundamentals, of the interaction of natural substances or forces. Can it then be described as an applied science? There is no doubt that it has been built up empirically, its methods have been developed over a long period of years, primarily as an individual skill. The practical aspect is older than the theoretical aspect, and since flour milling is essentially a matter of producing something, it is the practical aspect which is of ultimate importance. Undoubtedly milling has been developed and has been, and is being, practiced successfully by millers who have had no so-called scientific training at all. They have done everything by means of their personal skill and from their personal experience. Some of the development has undoubtedly come as the result of haphazard rule of thumb and trial and error methods: some has come through application of scientific method, either consciously or unconsciously. It can rightly be said that a pound of practice is worth a ton of theory in most circumstances, but theory can be used successfully to guide practice.

So it is in flour milling. The ultimate value in milling is the practical man who can produce the best flour in the largest amount from a given sample of wheat. He can benefit from the information given him by the various scientific workers and use their techniquie to some extent, but in the present state of our knowledge the problem is such that exact, precise treatment is not required or possible. I may possibly be called to task for suggesting that the miller and mill operative owe too much to the scientist and are playing second fiddle. It is, in any case, a matter of teamwork between the two sides. Milling today is undoubtedly an art as covered by the definition given earlier. "Art implies skill and ability, acquired through patient practice and directed toward a definite end."

New Terms and Titles

There seems to be a move these days to introduce new terms, distinctions and titles. Technology is one of these and in this connection we must be careful that a gap is not forced between science and its application in industry. Scientists and technologists are not two different breeds, they work in different branches, which are interdependent. Technology has in its turn introduced grades—technologist and technician, to cover different levels of training and operation. It may be that flour milling will move into this new circle, but whatever happens the skill of the individual and the interest of the individual will need to be an essential part of flour milling.

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The chapatti, which is generally made from atta, is an unleavened, baked or fried product. It is from 5 to 10 inches in diameter and somewhat less than one quarter inch thick. It serves both as an article of food and a tool for conveying food to the mouth. (One Brahmin told the writer that his father could not master or enjoy the use of a spoon or fork, and accordingly did not like to eat with Europeans.) It is made from a soft, unleavened and unfermented dough, and may be baked on a griddle or on the interior walls of a conical, charcoal fired oven. In this latter case, the disk of dough is slapped against the wall of the oven and is directly exposed to the heat from the fire. It is removed by iron hooks after it is baked. Variations in size and composition of the chapatti have distinctive names (parathas, puri, etc.). In some areas a sort of fermented chapatti is made using wild yeast, or in some cases milk curd, as fermenting agents.

Milling's Golden Era

Construction of Sieve Bolters

By W. D. Gray

A GOOD sieve bolter should occupy little space and take little power; be well built and easy to keep in order; have great capacity, considering the space and power required; should be easy to put into perfect balance, and it should stand on the mill floor without bracing and without shaking the building; be so constructed that it is possible to get at any of the sieves instantly, with no more trouble to get at the silk than a reel silk; it should impart the real hand-sieve or gyratory motion, which causes the impurities to float on top and the clean stock always next to the cloth, with nothing on the sieve to disturb or turn the stock over; should contain the largest amount of silk surface in the smallest space possible, which means capacity; should do the best and cleanest bolting with the least scouring action, and the perfect bolter should have a simple, substantial and automatic device to clean the cloth.

It seems to me the best way for the miller to fully understand a machine and see if it contains any or all of these desirable points is to describe this machine in detail; or to let him see it in pieces and as it is being put together. I am satisfied that, although there are over 800 of these machines in use in over 500 different mills, very few millers fully understand their mechanical construction and how the stock is worked on them.

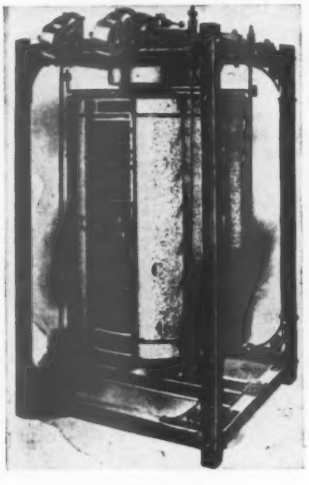

Fig. 1

This detailed description is made so that both its friends and foes will fully understand it; its friends to uphold it and its enemies, that they can the better show that it is no good; and it will save them the trouble of making distorted photographs of the machine to show to the miller to whom they would sell a machine of some other make. On the whole, the manufacturers of this machine think and have faith that a full understanding of it in its details will only result in good to all who are interested enough in this article to read and study it.

Fig. 1 shows a 70-inch machine, the largest that is made; "70 inch" means 70 inches in diameter to outside of the sieves. Further on I will show the detail, but it will be seen that one section of the other case is removed to show the sieves. All the sieves seen are not covered with silk or wire, but some of them simply a blank sieve covered with tin to carry the stock along, and can be removed just the same as the regular bolting sieve. Any sieve or other blank will fit into any place in the machine; the work of the machine can often be changed

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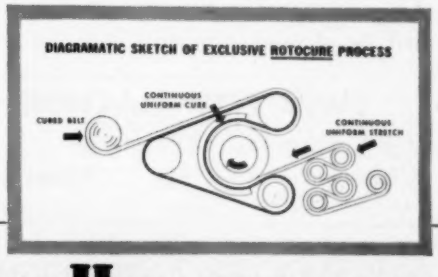

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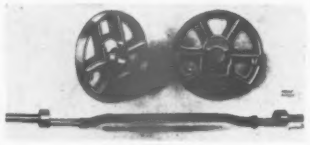

Fig. 2

without getting new sieves, by simply transposing sieves from one place to another.

The case is made of galvanized iron and is doubled with an air space to avoid condensation. This is important, for the machine is perfectly tight and the hot air going into the bolter with the meal would condense, form dough and fill up and rot the cloth, if the walls of this case were single; but having it doubled with the air space between keeps the bolter inside perfectly dry.

This case can be taken off and put back in place in a few minutes. The little door above and below the removed case goes into the feed and discharge-boxes and can be removed and replaced when the machine is in motion, if it be found necessary, in case of a choke-up, which may be caused by stock backing up from rolls, or from any other cause.

On the top and bottom of this cylinder two heavy flanges are bolted, to which the boxes or journal-bearings are bolted, the main shaft passing up through the center of the cylinder and boxes. The bolting cylinder is then hung on four hanger rods with ball and socket at each end, so that the cylinder swings free and easy, no weight resting on these hanger rods, except the cylinder.

Fig. 2 shows the eccentric shaft and the top and the bottom wheels. The shaft is a heavy forged shaft, the balance-wheel being keyed on the hubs shown on shaft, so that the bearings on shaft are the same as shaft diameter, to make as little friction as possible. It will be seen that these balance-wheels are quite heavy and have little pockets to put in stationary lead weights to properly put the machine in balance. It will also be seen that there is a large cast-iron weight that can be moved to or from the center by means of a screw; so that the machine can be put in perfect balance after it is loaded.

Fig. 3 shows the upper and lower flanges that are firmly bolted to, and become part of, the cylinder, the smaller being the upper one. These boxes are of the ball-and-socket type, the flange bored out and the box turned off so that the fit is perfect. They are babbitted with the best babbitt, which is hammered into the boxes, planed together, then bored

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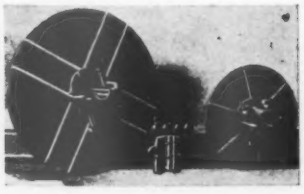

Fig. 3

and held in place by two heavy turned bolts. There are pockets in the casting that can be filled with oil, which act as reservoirs. These boxes are also supplied with grease forced into them by compression cups. The work on these begrings is as well done as the crank shaft of an engine. The largest flange is for the bottom, the better to support the weight and strengthen the machine, and to fasten the arms that reach out to form bearings for the lower end of hanging rods.

Fig. 4 shows the iron bridge-tree that supports the step for the lower end of the shaft; also the upper bridge-tree that supports the upper

Fig. 4

end of the shaft. As the upper end has two bearings the driving pulley being between the bearings, the grease compression cups are also shown with their connection pipes for the purpose of oiling these boxes.

Fig. 5 shows the step for the shaft, also the steel point for the shaft and the tempered steel buttons that point runs on. It will be seen that this step has a long bearing for the body of the shaft, the cap being bolted on with the heavy turned bolts,

Fig. 5

making the bearing ball and socket. The work on this bearing is done in the same substantial manner as the other bearings. This step taken in connection with its iron bridge-tree makes it very strong and substantial, and it supports no weight except the shaft, its two balance-wheels and driving pulleys, no part of the weight of cylinder resting on step, as the shaft is perfectly free in the boxes at top and bottom of cylinder, so that when the shaft revolves it imparts to the cylinder a free and easy gyratory motion. I have known incompetent men in handling this machine to so adjust the hanger rods that the whole weight of the cylinder rested on the hub of lower balance-wheel and causing the weight of the cylinder to rest on step. But for this there is no excuse and it only happens from gross ignorance.

Fig. 6 shows the inner drum. This drum contains all the spouts or passageways for the travel of the stock. The inside of this drum is made of hard wood, and where breaks or sharp stock travel, they are lined with galvanized iron. Inside cylinder just surrounding the center shaft is made of galvanized iron and connects at top and bottom with iron flange. This answers for the double purpose of keeping any dust or dirt out of the journals, and makes the machine absolutely fire-proof. The four rods shown on one end pass through the

Fig. 6

center of machine and through top and bottom flange, making the whole construction solid and substantial. Where the staves of this drum show short at both top and bottom represents the height of the feed and discharge-box.

Some one may say that if this machine chokes in the center, you cannot get at it. No one says so, however, that ever ran them or fully understood them, but it is usually the fellow that knows nothing about them, or is trying to sell something else. To begin with, the spouts are upright and this, together with the gyratory motion, makes it hard to choke it, but if this should happen, the sectional doors of the discharge box can be taken off while the machine is in motion, and anything that is limber can be run clear to the top of the machine if necessary, and at once remedy the trouble.

This machine will be further described and illustrated in the next of this series of articles.

Milling in India

The milling technology of India includes hand-powered burr mills, or chakkis, which produce "atta," power-driven chakkis, and modern flour mills with daily capacities up to 4,000 sacks. The roller mills are equipped

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to make one or more grades of flour (maida), fine and coarse semolina (suji and rawa), atta and bran and shorts (pollard), and in normal conditions these products are made simultaneously.

The power-driven chakkis operate largely on a custom grinding basis, operators being paid either in kind or in cash. The roller mills operate on the usual commercial basis, grinding grain which they own. During the current period of grain shortage, all mill operations are restricted to the production of atta, with percentage extraction, admixture of other cereal grains, and moisture levels in finished products being specified by governmental food agencies.

The admixture of other grains, 5 to 30%, and percentage extraction, 90 to 98%, vary in different provinces and from month to month, depending upon relative availability of wheat and other grains and the estimated requirement for atta. The government takes over the milled products, including feed, for distribution. It is noteworthy that in the large roller mills conventional, thorough cleaning and washing of wheat is the rule. Since production is restricted to atta, the purifier and sifting operations have been curtailed, but the actual grinding operations are continued on a basis of good craftsmanship.

In those parts of India where wheat is an important part of the diet, it is consumed largely in the form of chapattis or parathas (a chapatti fried in vegetable oil). For more ceremonial occasions puris and kachauris are eaten. In southern India uppuma, a sort of semolina pudding, has been a common dish. In the larger cities conventional bread has been an increasing item of wheat utilization.

Special Note: First published in 1947, this review of enrichment requirements in the U.S.A. is now brought up to date by the inclusion of milled white rice, the latest grain food to be fortified with vitamins and minerals. This year, the Tenth Anniversary of white bread and flour enrichment, is an appropriate time to publish a new edition of this popular, helpful resume. We shall be pleased to supply extra copies gratis. Just write our Vitamin Division.

The ROCHE REVIEW of enrichment requirements

ALL FIGURES REPRESENT MILLIGRAMS PER POUND

PRODUCT	Thiamine (B_1)		Riboflavin (B_2)		Niacin		Iron	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
Enriched BREAD, or other baked products	1.1	1.8	0.7	1.6	10.0	15.0	8.0	12.5
Enriched FLOUR[1]	2.0	2.5	1.2	1.5	16.0	20.0	13.0	16.5
Enriched FARINA[2]	1.66	–	1.2	–	6.0	–	6.0	–
Enriched MACARONI products[3]	4.0	5.0	1.7	2.2	27.0	34.0	13.0	16.5
Enriched NOODLE products[3]	4.0	5.0	1.7	2.2	27.0	34.0	13.0	16.5
Enriched CORN MEALS	2.0	3.0	1.2	1.8	16.0	24.0	13.0	26.0
Enriched CORN GRITS[4]	2.0	3.0	1.2	1.8	16.0	24.0	13.0	26.0
Enriched MILLED WHITE RICE[5]	2.0	–	*		16.0	–	13.0	–

1. *In enriched self-rising flour, calcium is also required between limits of 500-1500 mg. per pound.*
2. *No maximum levels have been enforced.*
3. *Levels allow for 30-50% losses in kitchen procedure.*
4. *Levels must not fall below 85% of minimum figures after a specific rinsing test described in the Federal Standards of Identity.*
5. *Levels must not fall below 85% of levels shown after washing and rinsing.*

*Omitted in the U.S.A. and Puerto Rico but used in certain Far Eastern countries to a minimum level of 1.2 mg. per pound.

The maximum and minimum levels shown above for enriched bread, enriched flour, enriched farina, enriched macaroni, spaghetti and noodle products, enriched corn meal and corn grits are in accordance with Federal Standards of Identity or State laws. Act No. 183 of the Government of Puerto Rico requires the use of enriched flour for all products made wholly or in part of flour. This includes crackers, pretzels, etc.

The levels for milled white rice are officially those of the Government of Puerto Rico. These levels are commonly accepted in U. S. domestic and export marketing and are based on the recommendation of the Committee on Cereals, Food and Nutrition Board, National Research Council.

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Feed Plant Layout

(Continued from page 1a)

modeling or building, and how to accomplish two things: (1) keep the different areas from conflicting, yet be in close cooperation for easy supervision and control, and (2) to have the areas open for easy future growth.

Close cooperation between the different activities is also important for another reason: Handling of materials. Feed milling basically is a material-handling problem and close relationship of the different activities makes material handling simpler and more practical. Judicious use of material handling equipment is a direct way to reduction in costs and the modern mill must be designed to make the most use of equipment available today. When I say "judicious use" I recall a plant where installation of a mechanical conveyor eliminated hand-trucking bagged feed more than 50 feet from the sewing machine to the boxcar. Those people were told that wheeling the bags is not the economical way. It was then found that, instead of one man wheeling the bags of feed, two men were needed—one to load the belt at the sewing machine, and one to unload the belt at the dock. A machine not judiciously used can be a mistake.

Mass-handling techniques were set forth by Sir Dudley North in England in 1680, and as early as 1791, Oliver Evans wrote on conveying and elevating equipment used in his flour mill descriptive of methods used today. Material handling is not new and in fact radically new methods of material handling have not been developed in our lifetime but the packaged type of equipment ready to be installed without too much effort has become available and this has helped more than any other one thing in educating industry in the use of this type equipment.

Cut Materials Handling Costs

If we would analyze a feed mill and break it down into its various parts to determine where movement takes place we would have something like this:

Receiving: We unload, **move** and store.

Preparation: We **move**, prepare, **move**, store or use.

Mixing: We **move**, mix, **move**, clean and bag.

Shipping: We **move**, load or store and **move**.

Every indication of movement is a

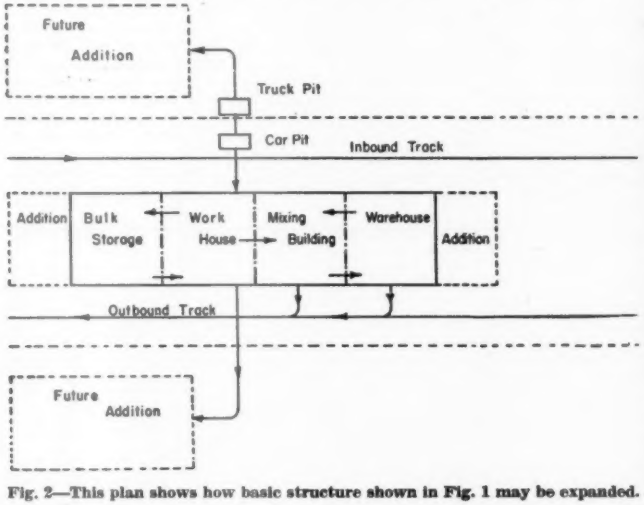

Fig. 2—This plan shows how basic structure shown in Fig. 1 may be expanded.

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material handling possibility. And every movement that is accomplished by manpower is at the rate of $10 per horsepower compared to 3¢ by a machine.

Good planning should go beyond just the adaptation of some means of transferring from one piece of equipment to another and we should not lose sight of the possibilities of combining the two pieces of equipment into one to eliminate the handling altogether or setting one over the other to take advantage of gravity or the elimination of some unnecessary piece of equipment. Material handling accomplishes more than mere movement as well planned cooperation between machinery raises the semi-skilled to the skilled classification which not only reduces our overhead but raises the standard of employment.

Keeping our thoughts in the overall perspective I would like to discuss some of the different operations in feed mills and their relation to each other.

We will start with the railroad tracks as this is the first step in entering the plant with materials and practically every mill has trackage. I have found where materials come in and go out by rail there is a distinct advantage to locate the mill between the tracks. This separates inbound material from outbound and reduces the confusion between the two types of operations. Inbound material coming in by sacks or bulk or by tank car requires a different type of facility than outgoing. Inbound bulk requires boxcar storage ahead of and behind the unloading pit which interferes with car spotting for outbound materials. Sack materials inbound are stored in different areas than finished feeds. Tank car unloading has no relation with outbound cars and is convenient if located near liquid storage. It is not always possible to have a division of the two tracks. Also smaller plants do not require the car capacity that larger plants do and there is a savings in cost when trackage can be placed on one side of the plant. In this case it is better to locate the outbound nearest the building and inbound on the outside track.

The receiving of materials should be between the working area and the bulk storage as logically the materials would go to either place but sometimes this location does not give sufficient car storage ahead of the unloading pit and the pit should be located in consideration of the cars rather than the building. This requires extra conveying costs but it is imperative that the unloading take care of the cars.

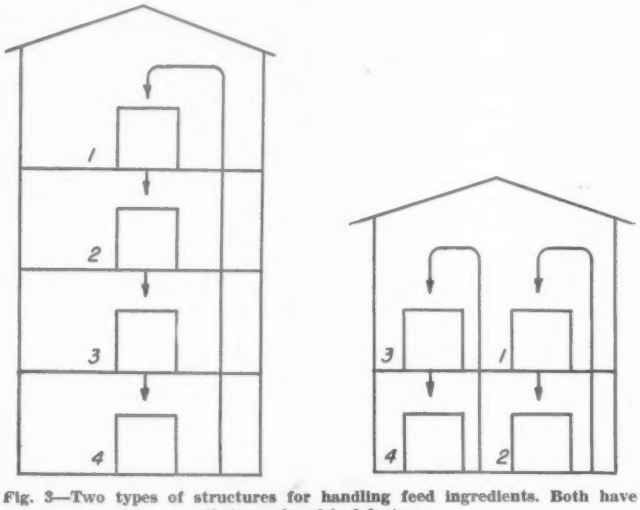


Fig. 3—Two types of structures for handling feed ingredients. Both have their good and bad features

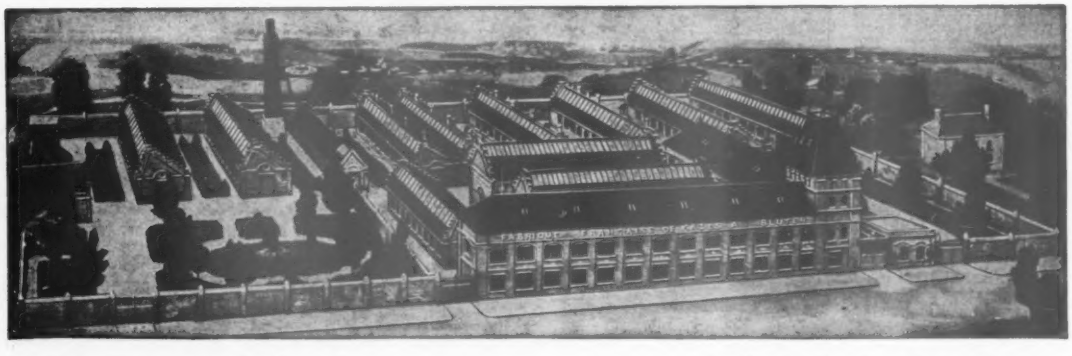
Material

The arrangement of bulk storage is usually long and narrow to take advantage of conveyors for handling material to and from storage but in some cases the type of operation and storage requirement may change the arrangement and in the smaller storage gravity can be used for distribution. Separate conveyors are required for grains and soft materials to keep from contamination but where belt conveyors or air can be used this is eliminated.

The mixing building is a different type from the storage building as the requirement here is for working space and a sufficient number of bins of the right size. There are some who advocate making the mixing building high and taking advantage of gravity. I can see some advantages to be gained in a lower type of building with the use of re-elevation equipment. In Figure 3 I have shown the two different type installations. One is by single elevation with the feed ingredients flowing by gravity between the four different pieces of equipment. The other depends upon multiple elevation to keep the operations on two floors. It is true that the additional elevation costs more to install and there is some additional power required, but supervision and control is easier and it does not take many choke-ups or breakdowns to offset the entire difference in the cost between the two types of buildings.

In general, I believe that most important factor in arranging pellet and crumble equipment (and this applies to scratch feed equipment as well) is to get all the equipment that requires attention on one or two floors and close enough together for simple supervision.

Pellets and crumbles are becoming more and more popular and the high cost of these operations makes it necessary that the best methods be used. I know of some cases where three men are required to operate this equipment just because the arrangement is spread out over the plant and is difficult to supervise. The job could be done by one man.



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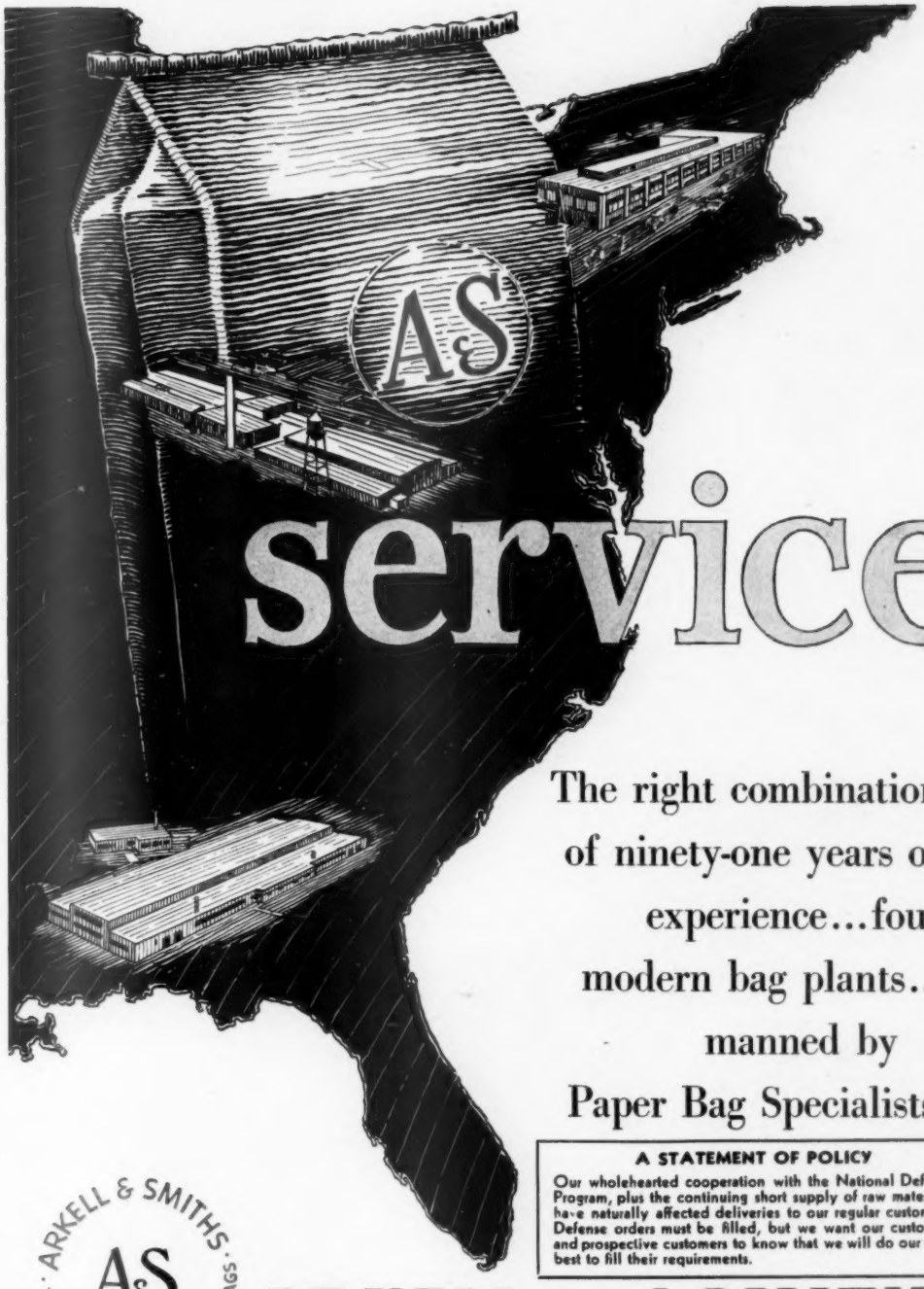

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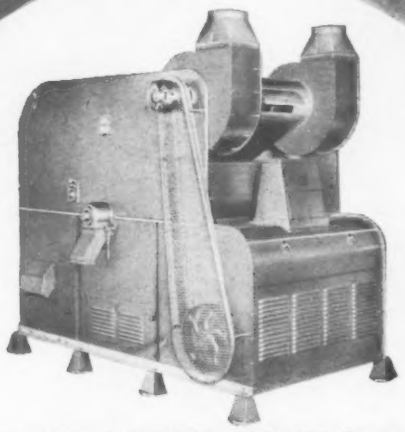

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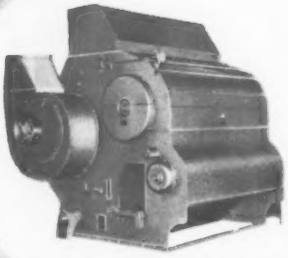

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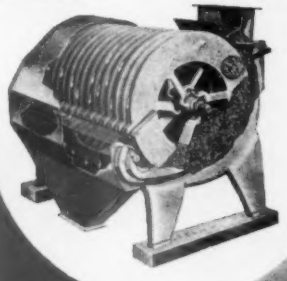

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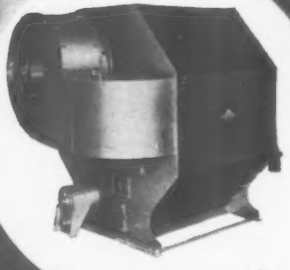

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